HRT-2 BEACON TRANSMITTER
TEST AND ACCEPTANCE
INSTRUCTION MANUAL

Copy of

This manual applies to
HRT-2 Beacon Transmitters
with serial no. 200 and above.

CONTENTS

LIST OF ILLUSTRATIONS

SECTION 1
DESCRIPTION

1.1 SCOPE OF MANUAL

This manual contains instructions for the set-up, operation, tuning, and maintenance of the HRT-2 Beacon Transmitter.

1.2 SYSTEM DESCRIPTION

The HRT-2 Beacon Transmitter is a 10-watt, battery-operated beacon which is used as a marker for aircraft direction-finding receivers. It transmits a carrier in the 1600 to 1750 kc frequency range which can be amplitude-modulated with either a continuous or keyed audio tone. Continuous or keyed tones are selected using an internal tone jumper.

1.3 DESCRIPTION OF PARTS PROVIDED

The HRT-2 Beacon Transmitter (figures 1 and 2) consists of a transmitter unit, a telescoping whip antenna, two batteries (one operating and one spare), a power cable, and a padded canvas carrying bag. The antenna is clipped to the side of the transmitter for storage. The operating battery is installed in the transmitter. All parts provided fit into the carrying bag.

1.3.1 TRANSMITTER UNIT

The transmitter unit is packaged in a 2 x 7 x 14-1/2-inch steel and aluminum housing. The housing has two compartments; one for the battery and one for the electronic circuits. The rf amplifier transistor is mounted on a heat sink on the outside of the housing, and is protected with a metal screen. Oscillator (I) and antenna (II) tuning controls and a tuning meter are mounted on top of the housing. The controls are adjusted for peak reading on the tuning meter. A pilot light, which lights only if sufficient battery voltage is available, illuminates the tuning meter. The pilot light assembly has a blackout shutter so that the light can be blocked, if desired. A spare pilot light is mounted in a clip inside the case. The end plate of the housing can be removed to change the battery and the bottom plate can be removed to change crystals and to change the tone jumper. A screwdriver for removing the two plates is chained and clipped to one side of the housing. A ground rod and the whip antenna are clipped to the other side. Four folding legs on the bottom plate open to provide a stable base when using the whip antenna. Antenna binding posts and an external power connector are mounted on top of the transmitter.

1.3.2 BATTERY

A type UWB-17 (supplied) mercury cell battery is used to power the HRT-2 Beacon Transmitter. Under average room conditions, the battery will operate for 6 to 7 hours. In cold weather, however, battery performance deteriorates rapidly. At 32 degrees F or 0 degrees C, the battery will operate for about 3 hours if first preheated to room temperature. If longer operation or cold weather operation (below about 60 degrees F or 15 degrees C) are required, an external power supply can be used. If the temperature is above 32 degrees F, a type UWG-17A cold temperature mercury pack can be used. This pack provides 3 hours of service even after long storage at 32°F. External power supplies should have an output voltage between 9 and 21 volts dc and should be capable of supplying 1 to 3.0 amperes respectively. The power cable supplied with the HRT-2 Beacon Transmitter is used to connect the external power supply. When using the internal battery, the shorting plug chained to the housing must be connected to the external power connector.

1.3.3 ANTENNA

The antenna supplied with the HRT-2 Beacon Transmitter is an omnidirectional 16-foot telescoping whip antenna. It has a low resistance and a high reactance. In use it is screwed into the socket on top of the transmitter and then raised, a section at a time, to its full height. Other antennas with higher resistance and lower reactance (such as Antennas HRN-2 or HRN-5) can be used to extend the range of the beacon. Auxiliary antennas are connected to antenna binding posts on the transmitter.

1.3.4 POWER CABLE

The power cable supplied with the HRT-2 Beacon Transmitter is used to connect the transmitter to external power supplies when the internal battery is not used. The power cable is six feet long and has two conductors. One end of the cable is terminated in a connector. The other end has tinned leads. The white lead is minus, the black lead is plus.

1.3.5 CARRYING BAG

The carrying bag supplied with the HRT-2 Beacon Transmitter is large enough to hold all items supplied including the spare battery. It is made of canvas and has a heavy padding to protect the equipment. There are two carrying straps on the bag. A shoulder harness enables the equipment to be conveniently carried on the back. A chest strap in the bag permits more solid fastening when desired.

1.4 OPERATING FREQUENCY

The HRT-2 Beacon Transmitter operates in the 1600 to 1750 kc frequency range. Each transmitter is supplied with a type ANL quartz crystal of the proper operating frequency installed. A second crystal is provided inside the transmitter for operation on an alternate frequency.

1.5 TONE MODULATION

The HRT-2 Beacon Transmitter transmits a carrier which can be amplitude-modulated with either a continuous or keyed 600 cps tone. When using the keyed tone, the tone is on for one to three seconds and then off for one to two seconds. Continuous or keyed tones are selected with a jumper inside the transmitter housing. With the jumper in position 1, keyed tones are used. With the jumper in position 2, a continuous tone is used. The tone jumper has a wire loop which serves as a handle.

1.6 PERFORMANCE SPECIFICATIONS

FREQUENCY RANGE	1600 to 1750 kc
FREQUENCY STABILITY	±100 cps
RF POWER OUTPUT	10 watts with 15-volt power supply; 3 watts with 9-volt power supply
MODULATION	Continuous or keyed tone
TONE FREQUENCY	600 cps
KEYING	Automatic; on 1 to 3 seconds, off 1 to 2 seconds
FREQUENCY MULTIPLICATION	None
INPUT VOLTAGE	15 volts dc nominal ±6 volts dc
INPUT CURRENT Tone off: Tone on:	 1 amp at 10 volts; 2.25 amps at 15 volts; 3.0 amp at 20 volts 1/2 amp at 10 volts; 1.75 amp at 15 volts; 2.5 amp at 20 volts
DIMENSIONS	2 x 7 x 14-1/2 inches
WEIGHT Beacon, less battery and bag: Battery (each): Carrying bag:	 12 pounds 9 ounces 5 pounds 12 ounces 4 pounds 8 ounces
BATTERY TYPES	Type UWG-17; mercury cell (supplied) or type UWG-17A mercury cold temperature pack (alternate); 20 volts nominal; 14 volts loaded
BATTERY LIFE Type UWG-17: Type UWG-17A:	 6 to 7 hours at room temperature; 3 hours at 32°F if preheated to room temperature 3 hours at temperatures above 32°F
ANTENNA IMPEDANCE	At antenna binding posts; 25 ±j500 ohms to 250 ±j500 ohms; 50 ohms resistive, nominal
TRANSISTOR COMPLEMENT	SM228 - Timer 2N1623 - Timer MM487 - Tone osc PT876 - Rf osc PT-932 - Rf ampl MM-487 - Switch 2N629 - Protector MM487 - Pilot light control

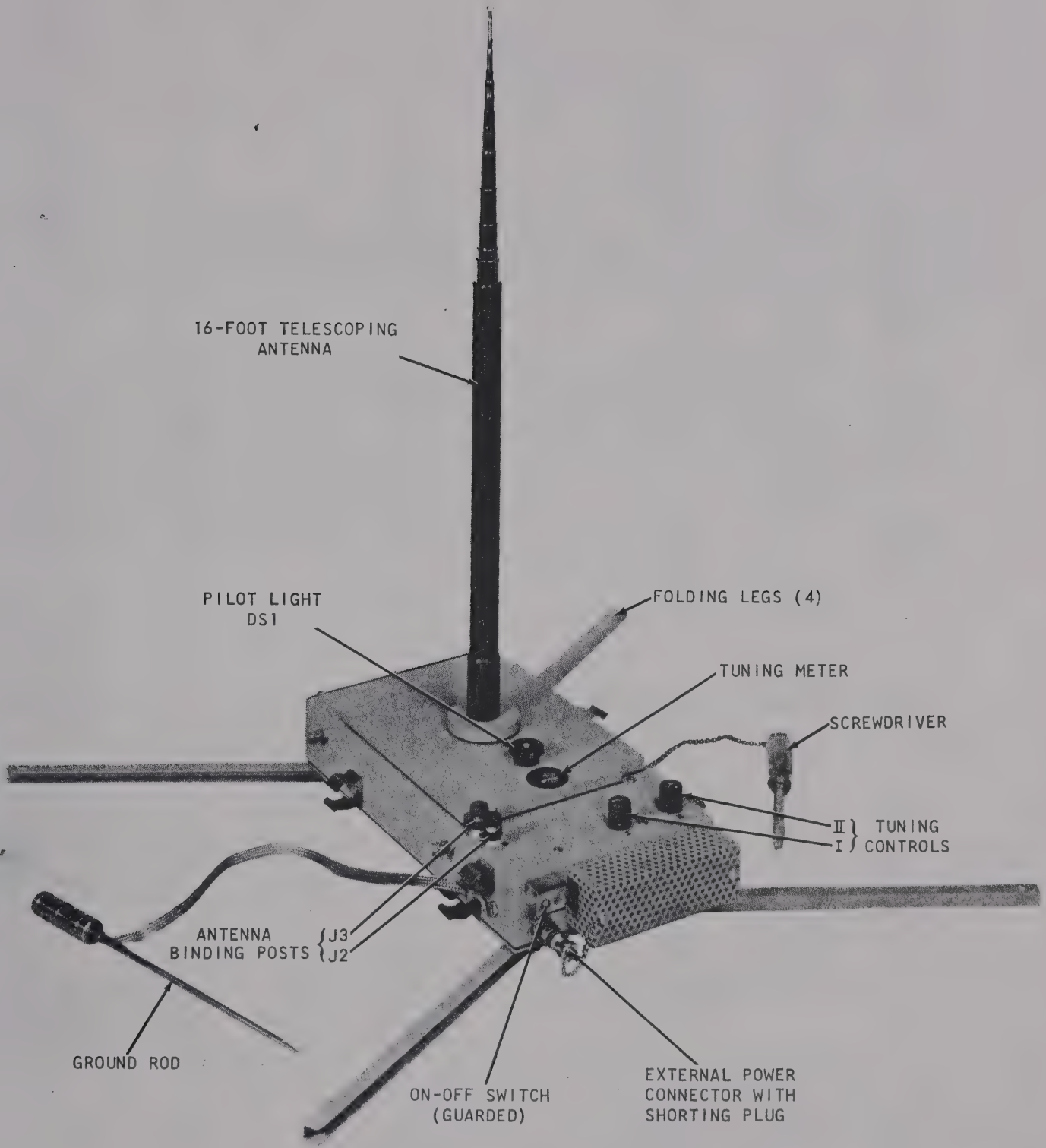


Figure 2. HRT-2 Beacon Transmitter, Top View

SECTION 2
SET UP AND OPERATION

2.1 SITING

For maximum range, the HRT-2 Beacon Transmitter should be set up in open terrain, on earth with low ground resistance, and in a flat area having at least a 25-foot radius. (Damp earth has low ground resistance.) Avoid obstructions such as high trees, towers, and wires.

2.2 TRANSMITTER SET-UP (See figures 2 and 3.)

2.2.1 BATTERY INSTALLATION

To install the battery, loosen the four captivated, knurled screws on the transmitter end plate and remove the end plate. Remove old battery, slide in the new battery, and plug in the battery connector. Be sure the connector is firmly seated. Replace the end plate, and tighten the four screws.

2.2.2 EXTERNAL POWER SUPPLY CONNECTION

Any power supply with an output voltage between 9 and 21 volts dc, capable of supplying between 1 and 3 amperes, respectively can be used in place of the internal battery. Before connecting the external power supply, set the on-off switch on the transmitter to off. The red dot near the switch indicates the on position. To connect the external power supply, remove the shorting plug from the power connector and connect the power cable supplied with the equipment. Connect the other end of the power cable to the external power supply observing the proper polarities; white negative and black positive. If the polarities are wrong, the equipment will not operate, however, no damage will occur.

2.2.3 TRANSMITTER INSTALLATION

Before installing the transmitter, be sure the battery is installed or that an external power supply is connected. Also, be sure the proper transmitter crystal is installed and that the desired type of modulation (continuous or keyed) has been selected. To install the transmitter, unfold the four legs by lifting the legs slightly and swinging them outward until they lock in place. The legs are detented at the proper angle. Set the transmitter as level as possible.

Note

The legs provide a stable mounting base when using the 16-foot whip antenna. When using other antennas, the legs do not have to be extended.

Ground the transmitter by driving the ground rod into the ground, up to the braid if possible. Efficiency of transmission, and therefore range, are affected greatly by grounding conditions. If ground conduction is poor, the natural grounds can be improved by using ground radials. These can be the ground wires provided with Antennas HRN-2 and HRN-5. If used, be sure the wires make good electrical connection with the transmitter ground rod shield braid.

2.2.4 ANTENNA INSTALLATION

Either the 16-foot whip antenna, or other antennas with impedances of 25 ±j500 to 250 ±j500 ohms (such as Antennas HRN-2 and HRN-5) can be used with the HRT-2 Beacon Transmitter.

2.2.4.1 16-FOOT WHIP ANTENNA

To install the 16-foot whip antenna, unclip the antenna from the transmitter housing. Screw the antenna into the threaded socket at the top of the transmitter, then, starting with the smallest section, pull each section out until the antenna is fully extended.

2.2.4.2 OTHER ANTENNAS

Antennas other than the 16-foot whip should be connected to the binding posts on the transmitter. The binding post next to the red dot is the "hot" output. The second binding post is a ground connection.

2.3 BEACON OPERATION (See figure 2.)

2.3.1 TURN ON PROCEDURE

After power has been supplied, and the antenna installed, the transmitter can be turned on. To turn on the beacon transmitter, lift the on-off switch guard slightly and set the on-off switch to on. The on position is marked with a red dot. The pilot light should light. With keyed tones, the tuning meter will flicker slightly as the tone is keyed.

WARNING

With the beacon transmitter in operation, high rf voltages exist along the exposed metal surfaces of the antenna. Avoid contact with the antenna when the beacon is operating.

If the pilot light does not light, check the battery for proper voltage. If an external power supply is being used, check the voltage and polarity of the supply. If these are normal, a short circuit probably is present.

CAUTION

Do not operate the equipment for over one minute with the pilot light not lit. This condition can indicate a short circuit which could damage the equipment (see par. 6.7).

2.3.2 TUNING PROCEDURE

The HRT-2 Beacon Transmitter is tuned for maximum output using the oscillator (I) and antenna (II) controls and the tuning meter. Oscillator tuning (I) is fairly broad while the antenna (II) tuning is very sharp. Unless the crystal has been changed, little or no adjustment of control (I) will be required. If the crystal frequency has been changed to a lower frequency, control (I) will have to be turned clockwise.

First tune the antenna (II) control for peak reading on the tuning meter, then peak the oscillator (I). Repeat the adjustment for peak reading. The oscillator (I) control range is about 10 turns. The antenna (II) control range is less than 1 turn.

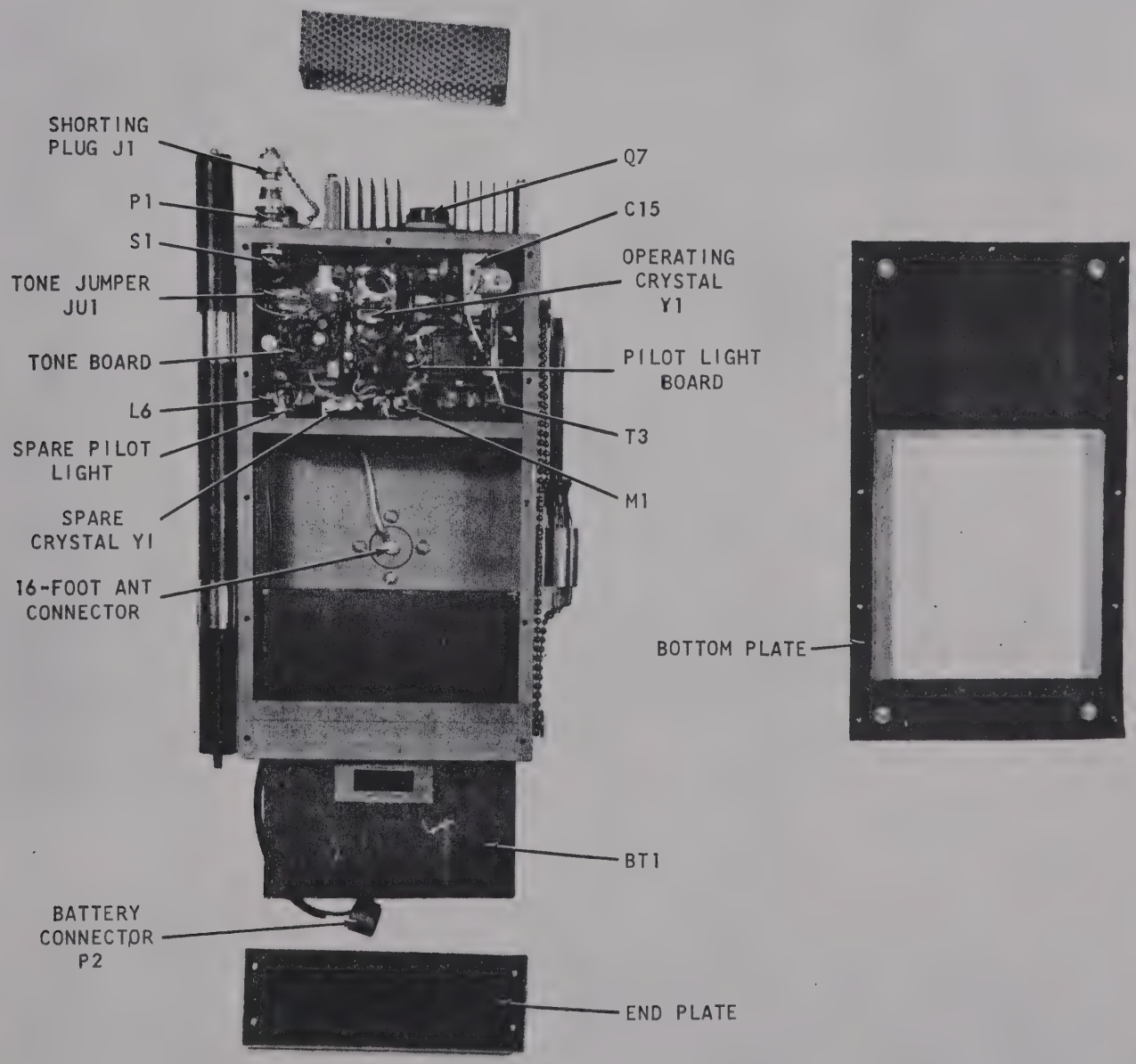


Figure 3. Transmitter, Bottom View with Bottom Plate Removed

SECTION 3

CHANGING FREQUENCY AND TONES

3.1 CHANGING FREQUENCY

To change the carrier frequency of the HRT-2 Beacon Transmitter, the oscillator crystal must be changed. To change the crystal, remove the end plate, loosen the 12 captivated screws on the bottom plate, and remove the bottom plate. The crystal is located in about the center of the electronic compartment (see figure 3). Remove the crystal by pushing back the retainer clip and pulling straight up on the crystal. The alternate crystal is clipped to the divider between the battery and electronic compartments. Plug the alternate crystal into the crystal socket making sure the crystal is firmly seated. Mount the first crystal in the alternate crystal clip. Replace the bottom plate. Tighten the screws until the gasket is uniformly compressed along all four edges. Replace the end plate.

Retune the transmitter in accordance with the instructions in paragraph 2.3.2.

3.2 CHANGING TONES

To change from keyed to continuous tones, a tone jumper (figure 3) must be changed in the transmitter. To change tones, remove end plate, loosen the 12 captivated screws on the bottom plate and remove the bottom plate. Pull out the tone jumper using the wire loop. Replace the jumper in the desired position. Position 1 is for keyed tones; position 2 is for continuous tones. Replace the bottom plate. Tighten the screws until the gasket is firmly compressed along all four edges. Replace the end plate.

SECTION 4
SERVICING

4.1 ALIGNMENT

Procedures for tuning the HRT-2 Beacon Transmitter are given in paragraph 2.3.2 and for changing frequency in paragraph 3.1. No other alignment or adjustments are required.

4.2 TROUBLE SHOOTING

The following table lists some of the troubles which can occur in the HRT-2 Beacon Transmitter and lists probable causes. To locate defective components or troubles not in the table, check the voltages in the equipment and compare the readings with those given on the schematic diagram.

SYMPTOM	PROBABLE CAUSE
Pilot light does not light	1. External power supply polarity reversed. 2. External power supply or battery voltage below nine volts. 3. Shorting plug not in place when using internal battery. 4. Internal short circuit. 5. Pilot light open. 6. Pilot light transistor Q5 defective.
Pilot light lights but tuning meter does not deflect.	1. Transmitter not tuned. 2. Defective, wrong, or no crystal Y1. 3. Improper load. 4. Rf oscillator Q6 defective. 5. Rf amplifier Q7 defective. 6. Tuning meter M1 defective.
Low power output.	1. Transmitter improperly tuned. 2. Rf oscillator Q6 defective. 3. Rf amplifier Q7 defective. 4. Protector Q8 defective.
No or inconsistent tone.	1. Power supply voltage too low. 2. Timer Q1 and Q2 defective. 3. Tone oscillator Q3 defective. 4. Switch Q4 defective.
Continuous tones with jumper in keyed position (1).	1. Power supply voltage too high.

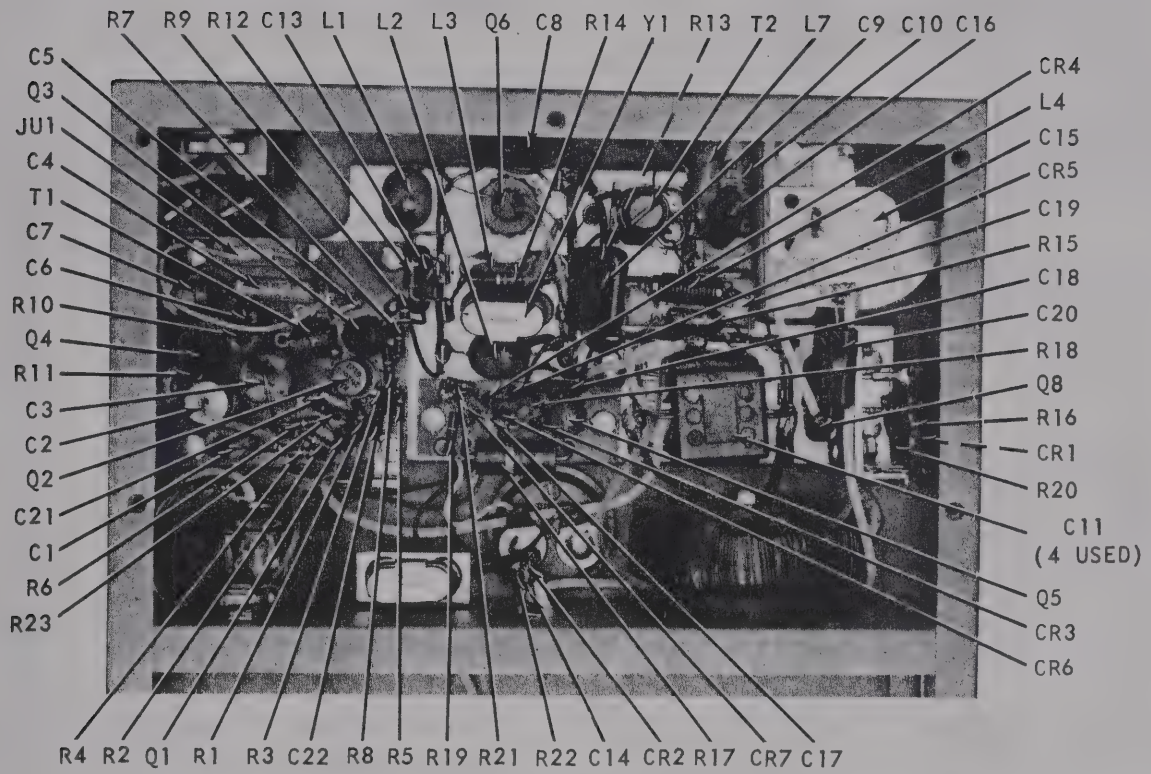


Figure 4. Transmitter, Parts Location

SECTION 5
TEST PROCEDURES

5.1 TEST EQUIPMENT REQUIRED

The following test equipment or their equivalents are required to test the HRT-2 Beacon Transmitter.

5.1.1 Variable dc power supply capable of supplying from 9 to 21 volts dc at 3 amperes.

5.1.2 Dummy loads consisting of various combinations of capacitors, inductors, and non-inductive resistors. These elements are combined to simulate antenna impedances of 25 ohms resistive, 50 ohms resistive, 250 ohms resistive, 25 +j500 ohms, 25 -j500 ohms, 250 +j500 ohms, and 250 -j500 ohms. Resistors should be capable of dissipating 20 watts.

5.1.3 Ac voltmeter, Hewlett-Packard Model 400D.

5.1.4 Dc voltmeter, RCA Voltohmyst.

5.1.5 Dc ammeter, Simpson Model 260.

5.1.6 Frequency counter, Hewlett-Packard Model 524.

5.2 POWER OUTPUT TEST

This test measures power output at the nominal power supply voltage of 15 volts dc and at 9 volts dc with the transmitter operating into dummy loads simulating the range of antenna impedances.

5.2.1 Connect a jumper from the base to the emitter of timer Q1. This disables the tone generator. (Fig. 4)

5.2.2 Connect the variable dc power supply to the external power supply connector using the power cable supplied.

5.2.3 Connect a 50-ohm 20-watt resistor to the antenna binding posts.

Note

A Bird Wattmeter can be used in place of the 50-ohm resistor to obtain an exact impedance match. However, the wattmeter cannot be read directly at this frequency range. Power output must be calculated using the ac voltmeter.

5.2.4 Connect the ac voltmeter across the 50-ohm load.

5.2.5 Turn the on-off switch to on. On position is marked with a red dot.

5.2.6 Adjust the variable dc power supply voltage to 15 volts.

5.2.7 Tune the transmitter using the procedure in paragraph 2.3.2. Maintain the power supply voltage at 15 volts.

5.2.8 Read the rf voltage on the ac voltmeter and compute the power output using the formula:

$P = E^2/R$

P = Power output (watts)

E^2 = Ac voltmeter reading squared

R = Dummy load resistance (disregard reactive components of load)

The power output should be at least 10 watts.

5.2.9 Set the power supply voltage to 9 volts.

5.2.10 Repeat steps 5.2.7 and 5.2.8. Power output should be at least 3 watts.

5.2.11 Set the power supply voltage to 15 volts.

5.2.12 Repeat steps 5.2.7 and 5.2.8 with the following dummy loads connected to the antenna binding posts in place of the 50-ohm load: 25 ohms resistive, 250 ohms resistive, 25 +j500 ohms, 25 - j500 ohms, 250 +j500 ohms, 250 -j500 ohms. Power output should not decrease more than 3 db below 10 watts (5 watts).

5.2.13 Turn off the transmitter and disconnect the test equipment. Be sure to remove the jumper from the base and emitter of Q1.

5.3 FREQUENCY TEST

5.3.1 Connect a 50-ohm dummy load across the antenna binding posts.

5.3.2 Loosely couple the frequency counter to the transmitter output.

5.3.3 Set the on-off switch to on and tune the transmitter using the procedure in paragraph 2.3.2.

5.2.4 Read the frequency counter. The reading should be within ±1000 cps of the frequency stamped on the crystal.

5.4 TONE GENERATOR TEST

5.4.1 Connect a 50-ohm dummy load across the antenna binding posts.

5.4.2 Place the tone jumper in the keyed tone position (1).

5.4.3 Tune the transmitter using the procedure in paragraph 2.3.2.

5.4.4 Connect the ac voltmeter across the dummy load. The ac voltmeter reading should fluctuate as the transmitter is keyed off and on. The reading should decrease for 1 to 3 seconds (tone on), and then increase for 1 to 2 seconds (tone off).

5.4.5 Set the on-off switch to off and disconnect the test equipment.

SECTION 6
THEORY

6.1 INTRODUCTION

The HRT-2 Beacon Transmitter consists basically of a 1600 to 1750 kc crystal-controlled rf oscillator and an rf amplifier which can be tuned over a wide range of output impedances. A tone oscillator and switch transistor turn the rf oscillator off and on at a 600 cps rate to provide an identifing tone. The tone oscillator can operate continuously or be, keyed automatically by a timer at a rate of 1 to 3 seconds on and 1 to 2 seconds off. An internal jumper selects keyed or continuous tones. A voltage-sensitive pilot light circuit senses the supply voltage. If insufficient voltage is present, the pilot light does not light. A protector circuit protects against excessive currents (caused by short circuits or excessive power supply voltage) and voltages of the wrong polarity.

6.2 RF OSCILLATOR

Rf oscillator Q6 oscillates at a frequency in the 1600 to 1750 kc range determined by crystal Y1. Y1 is a quartz crystal used in the series-resonant mode. As the crystal vibrates (oscillates), the piezoelectric effect causes currents to flow (at the crystal frequency) through the emitter-to-base junction of Q6 and the low impedance of the crystal. These currents are amplified and developed across the output circuit C9 and T2. The output circuit is tuned to the crystal frequency from the front panel using T2 (I). Regenerative feedback from the tap of T2 is applied to the emitter of Q6 through C8 to sustain the oscillations. L1 develops the feedback voltage. R12, R13, and R14 establish the oscillator bias voltages.

6.3 RF AMPLIFIER

The rf oscillator output is transformer-coupled through T2 to the base of the rf amplifier Q7. The rf amplifier is connected in a common-emitter circuit although the collector is electrically and physically connected to ground to permit efficient heat removal. The primary of T3, C11 and L4 form the collector load. R15 and C10 establish the bias for Q7. C19 is a dc blocking capacitor. L7 and C16 are a neutralizing network. The rf amplifier output is transformer-coupled to the antenna-matching circuit through T3. The antenna matching circuit consists of the secondary of T3, C20, and C15 (II). These components and the antenna (including loading coil L6, when the whip antenna is used) form a series resonant circuit. The antenna circuit is tuned to the operating frequency from the front panel using C15 (II). The antenna circuit has a high Q and therefore, is very sharply tuned. A sample of the antenna current is coupled from the antenna circuit through C14 and R22, rectified by CR2, and filtered by C17. The resulting current, which is proportional to antenna current, is measured by tuning meter M1. R19 calibrates the meter. CR7 in conjunction with R19 and R21 compresses the meter scale.

6.4 TONE OSCILLATOR AND SWITCH

Tone oscillator Q3 is a sine-wave oscillator which operates at about 600 cps. Oscillator tank circuit C4 and T1 is resonant at the tone frequency. Regenerative feedback is coupled from a tap on T1 to the emitter of Q3 through C5 to sustain oscillation. R7 and R8 establish the bias of Q3. The oscillator output, developed across R39, is coupled from the emitter of Q3 through C6 and R10 to the base of switch Q4. Switch Q4 is overdriven so that it is either in cutoff or saturation. The resulting square wave, developed across R11, is coupled to the base of rf oscillator Q6 through C7. The square wave alternately keys the rf oscillator off and on at a 600 cps rate. The tone oscillator operates only when the junction of R8, C4, and T1 is grounded. During continuous tone operation, the junction is grounded by tone jumper JU1. During keyed tone operation, the junction is effectively grounded through the low resistance of timer transistor Q2 when Q2 conducts. When Q2 is cut off, the junction is not grounded and the tone oscillator is biased off. The carrier is then unmodulated.

6.5 TIMER

Timer Q1 and Q2 is an RC oscillator which keys tone oscillator Q3 on for 1 to 3 seconds and then off for 1 to 2 seconds. In operation, R4 and R5 forward bias Q1, an NPN transistor. Conduction of Q1 through R1 and R3 also forward biases Q2. Q2 conducts, allowing C3 to charge through the emitter-to-base junction of Q1, and through R2 and Q2. Q1 and Q2 continue to conduct until C3 is charged. With C3 charged, the emitter-to-base current of Q1 decreases, decreasing the forward bias on Q2. Collector voltage of Q2 starts to rise, causing C3 to start discharging through R2, R4, R23 and R6. The discharge current overcomes the quiescent forward bias of Q1 across R4 to cut off Q1 and Q2. Q1 and Q2 remain cut off until C3 has discharged sufficiently so that the voltage across R4, caused by the discharge current, no longer exceeds the quiescent forward bias across R4. The quiescent forward bias across R4 then causes Q1 to start conducting, initiating a new cycle. The tone oscillator operates for the 1 to 3 seconds that Q2 is conducting and is keyed off for the 1 to 2 seconds that Q2 is cut off. R23, C21, and R6 provide degenerative feedback to stabilize the oscillator.

6.6 PILOT LIGHT CIRCUIT

Pilot light circuit Q5 controls lamp DS1 so that the pilot light lights only when the power supply voltage exceeds 9 volts. Current for the pilot light flows

through Q5. When the power supply voltage exceeds about 9 volts, sufficient current can flow through the emitter-to-base junction of Q5 to break down Zener diode CR3. This allows Q5 to conduct and light the pilot light. When the power supply voltage is less than about 9 volts, no current can flow through CR3 to the emitter-to-base junction of Q5. This causes Q5 to cut off, extinguishing the pilot light. Diodes CR4, CR5, and CR6 limit the voltage across the lamp to maintain a constant brightness and increase lamp life, C18, an rf bypass, prevents rf voltage from biasing CR3 into conduction when the power supply voltage is below about 9 volts.

6.7 PROTECTOR CIRCUIT

Protector circuit Q8 protects against excessive currents (caused by short circuit or excessive power supply voltage) and voltages of the wrong polarity. The emitter-collector junction of protector Q8 is connected in series with the ground connection of the power supply. In normal operation, Q8 is forward biased by R16 to drive the transistor into saturation. The emitter-to-collector voltage drop is about 0.2 volt, causing negligible loss to the transmitter circuits. When excessive currents are drawn, the voltage on the emitter-base junction increases due to the emitter resistance, and the base current is shunted through CR1. Conduction of Q8 decreases, causing the emitter-to-collector voltage to increase to the supply voltage. With a complete short circuit from ground to B-, current through Q8 is limited to about 3 amperes. Note that no voltage appears across the transmitter circuits since all of the voltage is dropped across Q8. If the power supply is connected with the wrong polarity, the emitter-to-base junction of Q8 and CR1 are reverse biased, cutting off Q8. Q8 then acts as an open circuit, preventing application of voltage to the transmitter circuits. Because of the high power dissipation of Q8, the beacon should not remain on for extended periods of time with a short circuit present. After 5 minutes, it is conceivable that Q8 will short. After the equipment short is cleared, the beacon will operate even with Q8 shorted; however; there will be no current limiting or power supply reversal protection if Q8 is still shorted.

SECTION 7
PARTS LIST

7.1 LIST OF REPLACEABLE PARTS

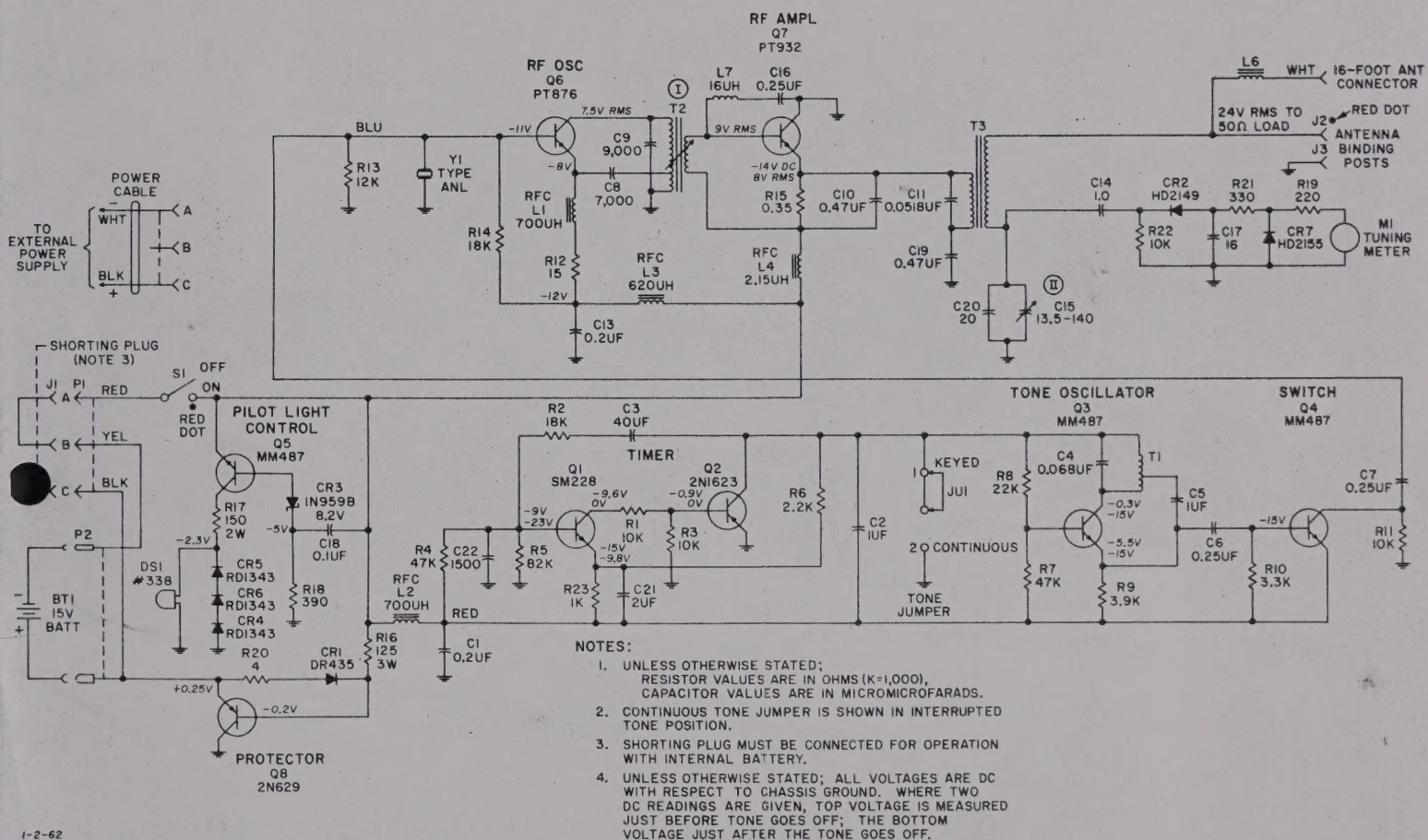
REFERENCE SYMBOL	MANUFACTURER	DESCRIPTION
		BATTERY:
BT1		15v; type UWB-17 (supplied); type UWB-17A (alternate cold. temp. pack)
		CAPACITOR:
C1	Erie	ceramic; 0.2 uf; 25 vdcw
C2	Potter Co.	Mylar; 1.0 uf; 200 vdcw
C3	P. R. Mallory	Tantalum; solid; 40 uf; 60 vdcw
C4	J. E. Fast	Mylar; 0.068 uf; 200 vdcw
C5	J. E. Fast	Mylar; 1.0 uf; 100 vdcw
C6	Potter Co.	Mylar; 0.25 uf; 200 vdcw
C7		Same as C6
C8	Elmenco	Mica, dipped; 7000 uuf
C9	Elmenco	Mica, dipped; 9000 uuf
C10		Same as C5
C11	Aerovox	Four used: three 0.015 uf; one 0.0068 uf; mica; molded
C12		Not used
C13		Same as C1
C14	Quality Comp.	type QC; 1 uuf
C15	E. F. Johnson	Variable; air; 13.5-140 uuf
C16		Same as C6
C17		Not used
C18	Erie	ceramic; 0.1 uf; 25 vdcw
C19		Same as C5
C20	Elmenco	Mica; molded; 20 uuf
C21	Ohmite	Tantalum; 2 uf; 10 vdcw
C22	Glenco	ceramic; 1500 uuf
		DIODE:
CR1	Radio Receptor	DR435
CR2	Hughes Aircraft	HD2149
CR3	Motorola	1N959B
CR4	Rheem	RD1343
CR5		Same as CR4
CR6		Same as CR4
CR7	Hughes Aircraft	HD2155
		LAMP:
DS1	Dialight	Type 338
		CONNECTOR; Receptacle:
J1	Bendix	Power connector; type PC07E-8-3P
J2		Binding post; black; part no. 567-B-173
J3		Binding post; red; part no. 567-B-173
		COILS:
L1		Choke; rf; 700 uh; part no. 567-B-168
L2		Same as L1
L3		Choke; rf; 620 uh; part no. 567B-168A
L4		Choke; rf; 2.15 uh; part no. 567-B-165
L5		Not used
L6		Coil; antenna; toroidal; part no. 567-B-164
L7		Coil; rf; 16 uh
		METER:
M1		Meter, tuning, part no. 567-B-140

REFERENCE SYMBOL	MANUFACTURER	DESCRIPTION
		CONNECTOR; Plug:
P1	Bendix	Shorting
P2	Cinch	Battery connector
		TRANSISTOR:
Q1	Motorola	SM228
Q2	Raytheon	Type 2N1623
Q3	Motorola	MM487
Q4		Same as Q3
Q5		Same as Q3
Q6		Same as Q5
Q7	Pacific Semi-conductor	Type 932
Q8	Motorola	Type 2N629
		RESISTOR:
R1	Allen-Bradley	10K; ±10%; 1/4-watt
R2	Allen-Bradley	18K; ±10%; 1/4-watt
R3		Same as R1
R4	Allen-Bradley	47K; ±10%; 1/4-watt
R5	Allen-Bradley	82K; ±10%; 1/4-watt
R6	Allen-Bradley	2.2K; ±10%; 1/4-watt
R7	Allen-Bradley	47K; ±10%; 1/4-watt
R8	Allen-Bradley	22K; ±10%; 1/4-watt
R9	Allen-Bradley	3.9K; ±10%; 1/4-watt
R10	Allen-Bradley	3.3K; ±10%; 1/4-watt
R11		Same as R1
R12	Allen-Bradley	15 ohms; ±10%; 1/2-watt
R13*	Allen-Bradley	12K; ±10%; 1/2-watt
R14	Allen-Bradley	18K; ±10%; 1/2-watt
R15	Ohmite	Wirewound; 0.35 ohm; ±10%; 3-watt
R16	Ohmite	Wirewound; 125 ohms; ±10%; 3-watt
R17	Allen-Bradley	150 ohms; ±10%; 2-watt
R18	Allen-Bradley	390 ohms
R19	Allen-Bradley	220 ohms; ±10%; 1/4-watt
R20		Not used
R21	Allen-Bradley	330 ohms; ±10%; 1/4-watt
R22	Allen-Bradley	10K; ±10%; 1/4-watt
R23	Allen-Bradley	1000 ohms; ±10%; 1/4-watt
		SWITCH:
S1	Cutler-Hammer	Switch; spdt
		TRANSFORMER:
T1	Sky-Sweeper	Transformer
T2		Osc coil assy; part no. 567-B-166
T3		Transformer; torodidal; part no. 567-B-163
		CRYSTAL:
Y1		Quartz; type ANL

*R13 is factory-selected for proper power output

7.2 LIST OF MANUFACTURERS

MANUFACTURER	ADDRESS
Aerovox Corp.	740 Belleville Ave., New Bedford, Mass.
Allen Bradley Co.	136 W. Greenfield Ave., Milwaukee, Wisc.
Bendix Corp., Scintilla Division	Sidney, N. Y.
Cinch Mfg. Co.	1026 S. Homan Ave., Chicago, Ill.
Cutler-Hammer, Inc.	321 N. 12th St., Milwaukee, Wisc.
Dialight Corp.	60 Stewart Ave., Brooklyn, N.Y.
Elmenco (Electro Motive Mfg. Co.)	So. Park and John St., Willimantic, Conn.
Erie Resistor Corp.	644 W. 12th St., Erie, Pa.
Fast, John E., and Co.	3580 N. Elston Ave., Chicago, Ill.
Glenco Corp.	212 Durham Ave., Metuchen, N.J.
Hughes Aircraft Co.	500 Superior Ave., Newport Beacon, Calif.
International Instruments, Inc.	88 Marsh Hill Rd., Orange, Conn.
Johnson, E. F., Co.	1439 Second Ave., SW, Waseca, Minn.
Mallory, P.R., and Co., Inc.	3029 E. Washington St., Indianapolis, Ind.
Motorola Semi-conductor Products, Inc.	500 SE. McDowell Rd., Phoenix, Ariz.
Ohmite Mfg. Co.	3635 Howard St., Skokie, Ill.
Pacific Semiconductors, Inc.	12955 Chadrow Ave., Hawthorne, Calif.
Potter Co.	1950 N. Sheridan Road, Chicago, Ill.
Quality Components Corp.	Saint Mary, Pa.
Radio Receptor Co., Inc.	240 Wythe Ave., Brooklyn 11, N.Y.
Raytheon Mfg. Co.	411 Providence Tpk., Westwood, Mass.
Rheem Semiconductor Corp.	350 Ellis St., Mountain View, Calif.
Sky-Sweeper, Inc.	McHenry, Ill.



NOTES:

1. UNLESS OTHERWISE STATED; RESISTOR VALUES ARE IN OHMS (K=1,000), CAPACITOR VALUES ARE IN MICROMICROFARADS.
2. CONTINUOUS TONE JUMPER IS SHOWN IN INTERRUPTED TONE POSITION.
3. SHORTING PLUG MUST BE CONNECTED FOR OPERATION WITH INTERNAL BATTERY.
4. UNLESS OTHERWISE STATED; ALL VOLTAGES ARE DC WITH RESPECT TO CHASSIS GROUND. WHERE TWO DC READINGS ARE GIVEN, TOP VOLTAGE IS MEASURED JUST BEFORE TONE GOES OFF; THE BOTTOM VOLTAGE JUST AFTER THE TONE GOES OFF.

1-2-62

Figure 5. HRT-2 Beacon Transmitter. Schematic Diagram